



Engineering Sciences Section – 2007

C10 The “Critical Speed Formula” Revisited With Computer Simulations and a Sophisticated Math Model

Donn N. Peterson, MSME, PE, Peterson Engineering, Inc., PO Box 664, Brainerd, MN 56401-0664; Donald J. Anderson, BSME, PE, Anderson Engineers, LLC, 13176 Pierce Street NE, Minneapolis, MN 55434*

After attending this presentation, attendees will learn the influences of a variety of parameters on the error from using the common “critical speed formula” to estimate vehicle speed from measured curved tire marks on a roadway.

This presentation will impact the forensic community and/or humanity by quantifying the expected errors introduced by using the simplified “critical speed formula” for estimating vehicle speeds under a variety of operating conditions.

Background: Years ago a formula was derived, using many simplifying assumptions, to estimate the speed of a vehicle when it made tire marks in a turn or curve. The results can be a useful input in early stages of an accident reconstruction because they can provide “ballpark” values for a possible range for the vehicle speed.

Problems developed over the years because non-suspecting accident reconstructionists began to assign much greater accuracy to the speeds they calculated by using the simplified “critical speed formula” than they should. Such calculated speeds are often faster than the actual vehicle speed and may lead to erroneous conclusions about pre-crash speeds and a driver's negligence.

Several presentations have been given by AAFS members on this topic over the past decade. Some presenters gravely criticized use of the “critical speed formula” and others defended its use. Since truth is often somewhere between the extremes, the authors performed studies to provide an understanding of the effects and probable errors of some common factors that influence calculated results.

The authors used a version of the “3-D Math Model for Vehicle Dynamics Simulation Including Effects of Tires, Suspensions, and Terrain” published in the NAFE Journal DEC 1998. A presentation of which was first made by the presenting author in 1994 at the AAFS Meeting in San Antonio.

Accident Reconstruction, Speed Errors, Critical Speed Formula